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(56) Documents Cited

US 5173026 A

(58) Field of Search

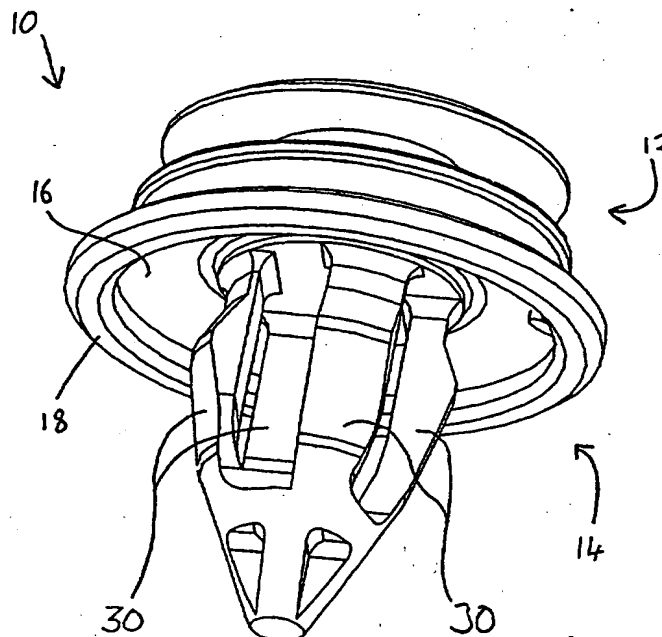
UK CL (Edition R ) E2A AAN ACAF ACAT  
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43/02  
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(54) Abstract Title

Improvements relating to fasteners

(57) The present invention relates to a fastener for fastening a first element to a second element having an aperture and for sealing said aperture. The fastener comprises a first engageable means 12 for engaging with a first element (not shown) and a second engageable means 14 extendable through the aperture in the second element for engaging the edge portion means on each side of the second element. The second engageable means 14 includes a resilient skirt 16 having a resilient sealing ring 18 moulded to and engaging a peripheral lip 20 thereof, the lip 20 extending into the sealing ring 18. The sealing ring 18 is engageable with the edge portion means on one side of the second element for sealing the aperture in such a way that disengagement of the sealing ring 18 from the lip 20 is prevented.

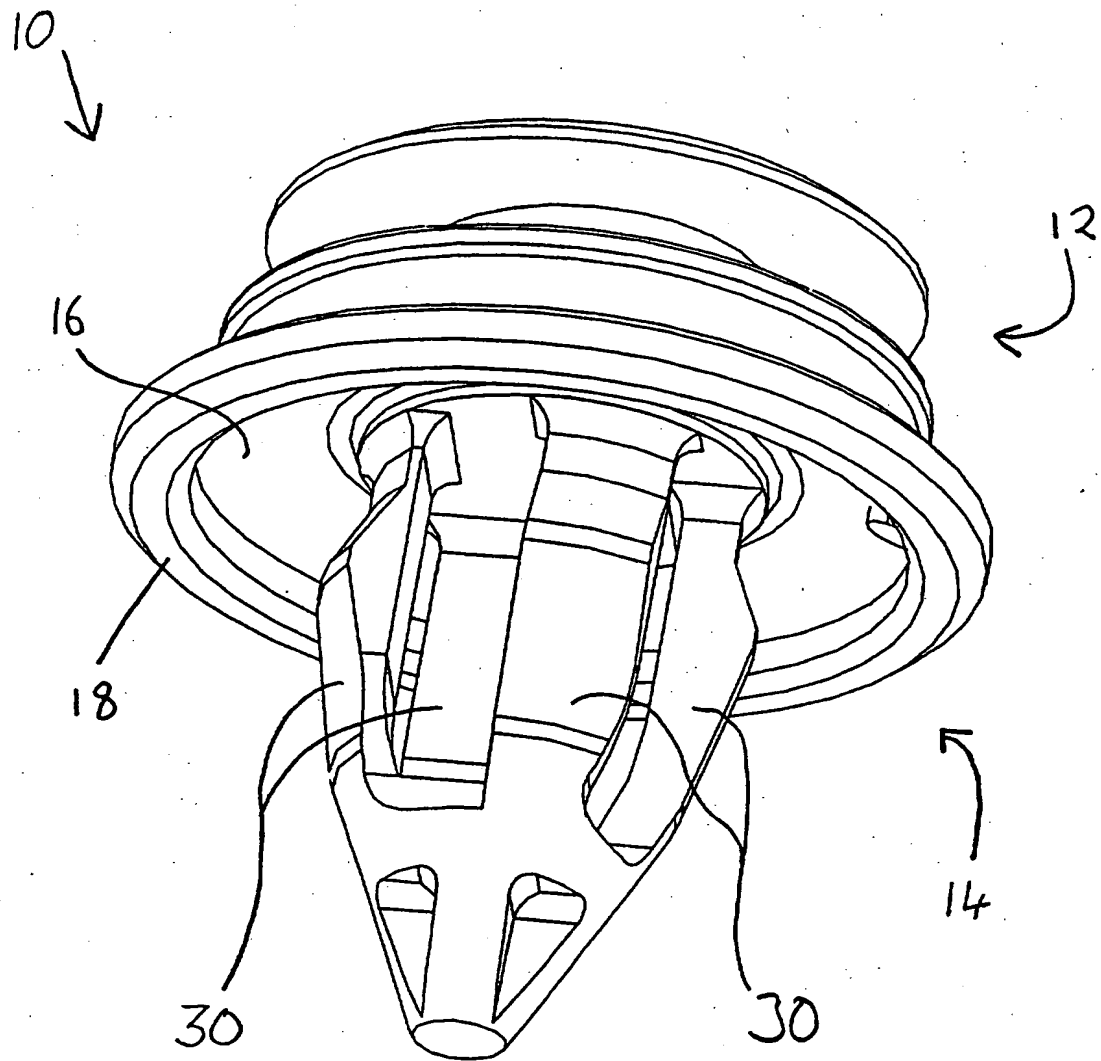
FIG 1



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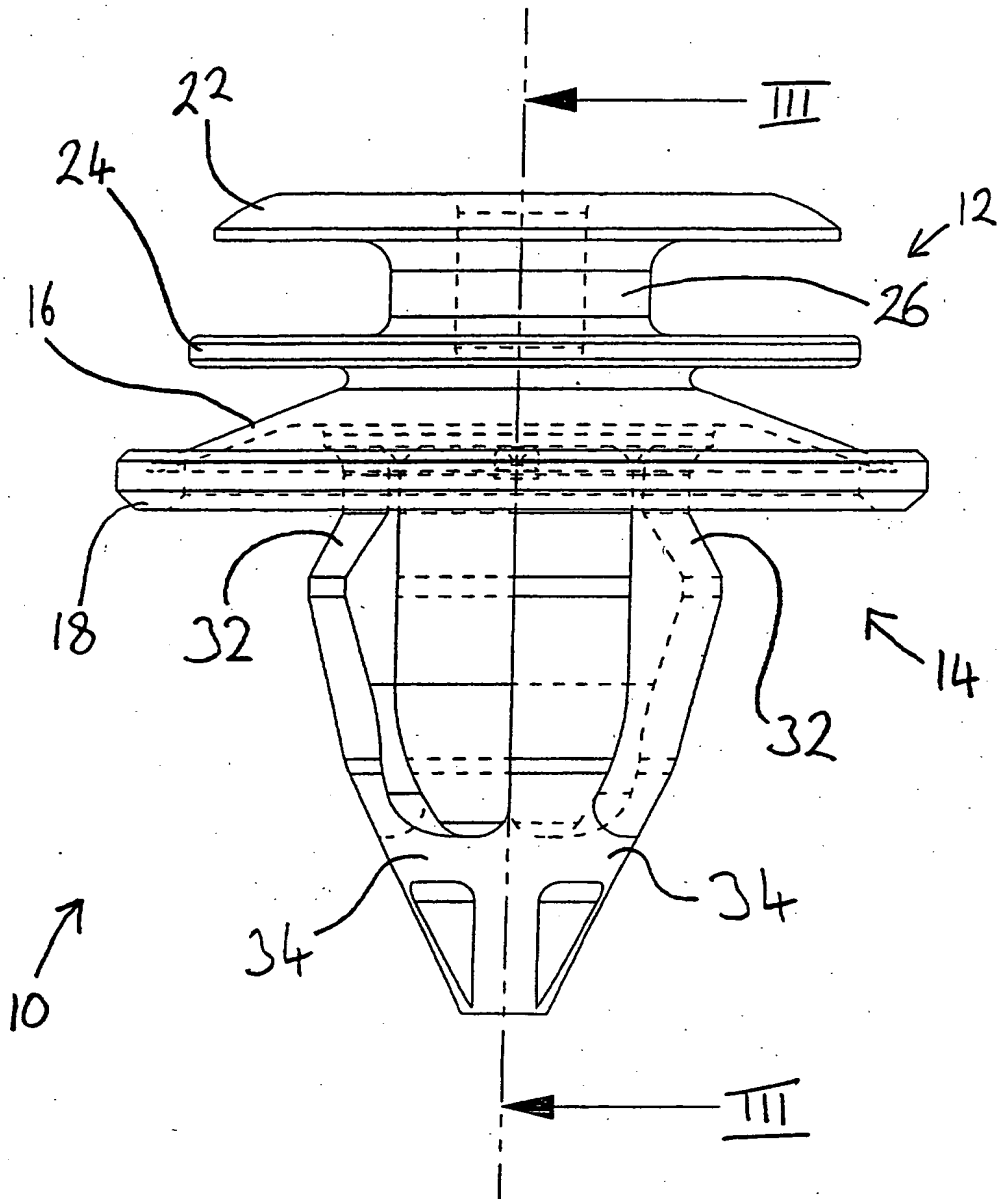
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FIG 1



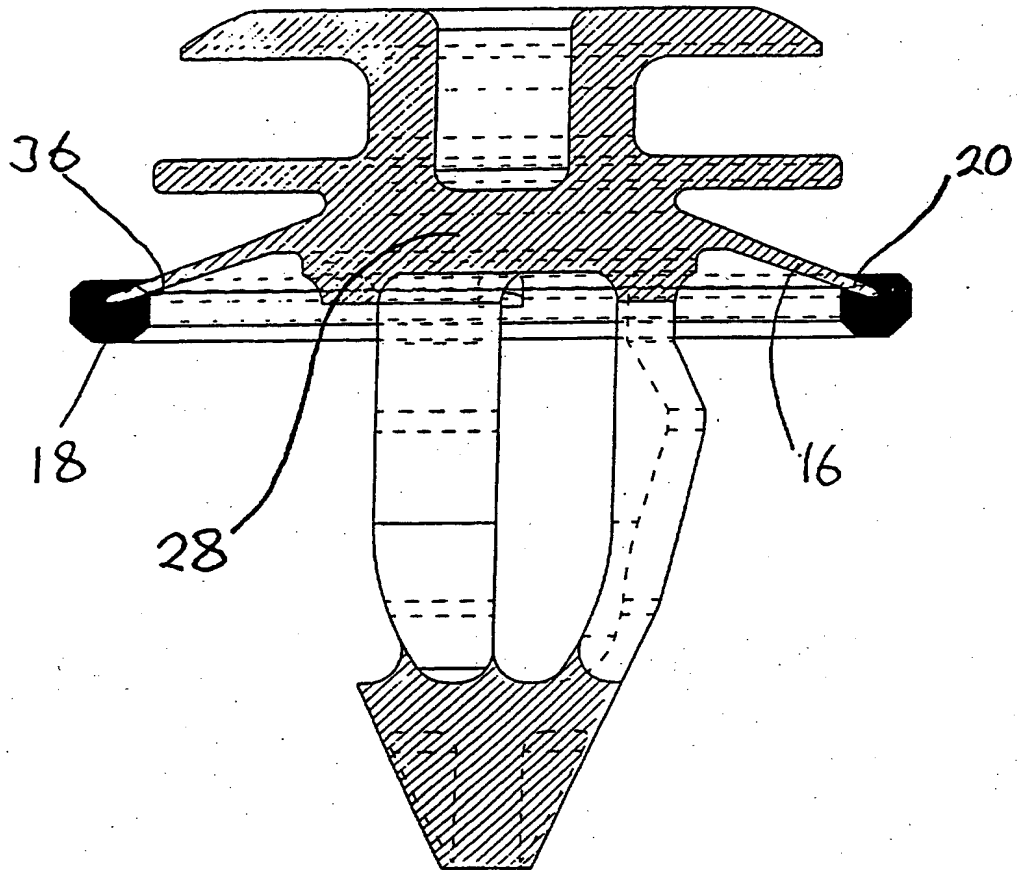
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FIG 2



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FIG 3



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FIG 4

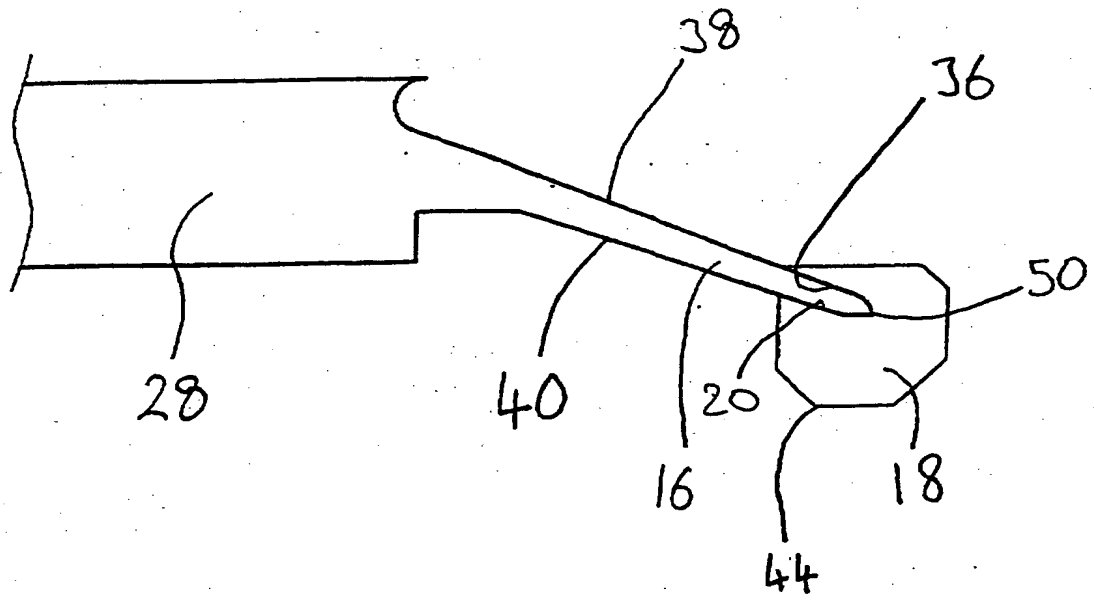
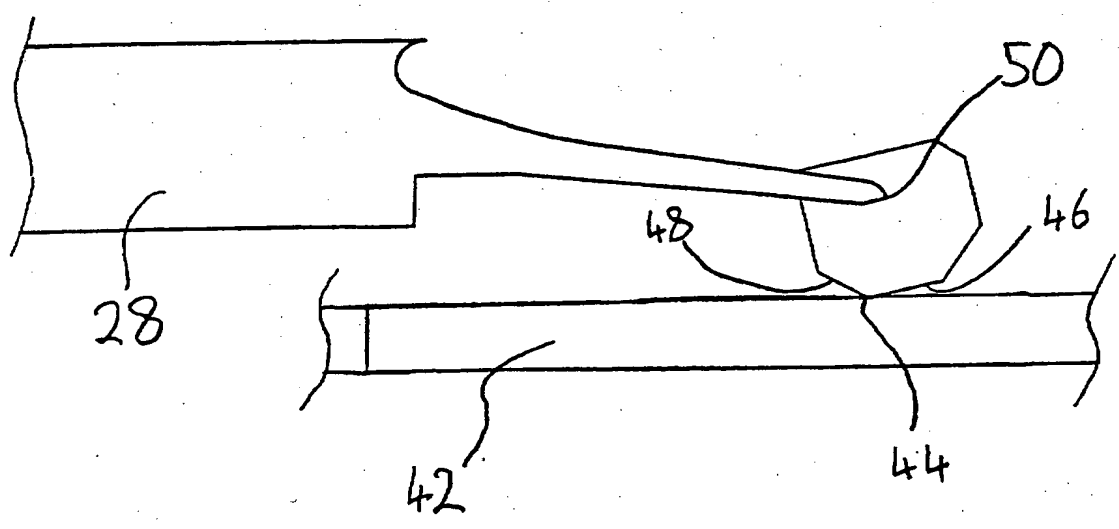


FIG 5



## Improvements relating to Fasteners

The present invention relates to a fastener for fastening a first element to a second element having an aperture and for sealing said aperture.

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Fasteners for fastening a trim panel to a metal panel are well known within the automobile industry. One way in which the fastener can be engaged with a metal panel is by providing the metal panel with an aperture through which the fastener is extendible and engageable with an edge portion of the metal panel defining the aperture on each side of the metal panel. The fastener may comprise a skirt having a lip which resiliently engages the edge portion on one side of the metal panel but such engagement is not usually sufficient to prevent the ingress of moisture through the aperture. It is therefore desirable to seal the contact surface between the skirt and the metal panel.

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Previously, a plastic sheet has been provided on one side of the metal panel and is positioned between the fastener and the metal panel at the contact surface. The plastic sheet has an aperture through which the fastener is extendible and the skirt is engageable with the plastic sheet at the edge portion of the metal panel. Such an arrangement is somewhat cumbersome and does not facilitate assembly.

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It is also known to provide a plastic washer which is fitted loosely to the fastener prior to assembly and which seals the contact surface between the skirt and the metal panel when the fastener is engaged therewith. Such a fastener requiring a separate washer to be fitted prior to assembly is not  
5 desirable from an efficiency point of view.

In order to reduce assembly time and increase overall efficiency the present invention provides a fastener with a sealing ring moulded thereto.

10 The present invention includes a fastener for fastening a first element to a second element having edge portion means defining an aperture, the fastener comprising a first engageable means for engaging with said first element and a second engageable means extendible through said aperture for engaging the edge portion means on each side of said second element, said second  
15 engageable means including a resilient skirt having a resilient sealing ring moulded to and engaging a peripheral lip thereof, said lip extending into said sealing ring, said sealing ring being engageable with the edge portion means on one side of said second element for sealing the aperture in such a way that disengagement of the sealing ring from the lip is prevented.

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Preferably, in radial cross-section the sealing ring has a sealing surface formed by the interface of two complimentary surfaces of the sealing ring.

The sealing ring may be polygonal in radial cross-section.

5 It is preferred that the sealing surface is radially inward of the outer radial periphery of the lip.

The lip may extend into the sealing ring so that the sealing ring extends substantially equally over an upper and a lower surface of the skirt.

10 The sealing ring is preferably made from a thermoplastic elastomer (TPE) which has the mechanical properties of rubber but which is also easily processed. The rest of the fastener is preferably resilient having a good shape memory, thermally resistant to about 90°C to 100°C, and reusable. Acetal resin is an example of a material which possesses these properties.

15

Two different plastics materials can be bonded together mechanically or molecularly. In a mechanical bond the different plastics are interlocked and are bonded independent of adhesion between the materials. In a molecular bond the molecules of each material interact to form the bond.

20

Acetal resin and TPE do not form molecular bonds at moulding temperatures sufficiently to prevent disengagement of the sealing ring from the lip of the



skirt and the functionality of the skirt and the sealing ring is not conducive for forming mechanical bonding between the materials. However, the arrangement of the invention prevents the sealing ring from disengaging from the lip of the skirt.

5

In order that the present invention may be well understood an embodiment thereof which is given by way of example only will now be described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a fastener;

10 Figure 2 is a side view of the fastener shown in Figure 1;

Figure 3 is a cross-sectional view taken along line III-III in Figure 2;

Figure 4 is a cross-sectional view of a sealing ring and a skirt of the fastener shown in Figure 1 at rest; and

15 Figure 5 is a cross-sectional view of the sealing ring and the skirt of the fastener shown in Figure 1 in use.

Referring to the Figures, the fastener 10 is for fastening a trim panel to a metal panel having edge portion means defining an aperture. The fastener comprises a first engageable means 12 for engaging with a trim panel (not shown) and a second engageable means 14 extendible through the aperture in the metal panel for engaging the edge portion means on each side of the metal panel. The second engageable means 14 includes a resilient skirt 16 having a

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resilient sealing ring 18 moulded to and engaging a peripheral lip 20 thereof, the lip 20 extending into the sealing ring 18. The sealing ring 18 is engageable with the edge portion means on one side of the metal panel for sealing the aperture in such a way that disengagement of the sealing ring 18 from the lip 20 is prevented.

In more detail, the first engageable means 12 comprises opposing flanges 22, 24 connected by a neck portion 26 for engaging with a trim panel. The opposing flanges 22, 24 are positioned either side of an inwardly projecting bracket of the trim panel with the neck portion 26 being accommodated in an aperture or recess of the bracket. Other structures may be used for engaging the fastener with the trim panel and the present invention is not restricted to the particular structure described here.

The second engagable means 14 comprises a central body 28 extending from the first engageable means 12. The skirt 16 which is conical extends outwardly from the central body 28 and away from the first engageable means 12. Four legs 30 extend from the central body for engaging the edge portion means on an opposing side of the metal sheet to that of the sealing ring 18. The legs 30 are deformable radially inwardly to allow them to be inserted through the aperture in the metal panel and are resilient to engage the edge portion means after insertion. Each leg has a tapered portion 32 to allow the

legs to engage with panels of any one of a plurality of thicknesses. The legs are joined together at their respective ends 34 distal from the skirt to increase rigidity.

5 The sealing ring 18 and the skirt 16 are best described with reference to Figures 3 to 5. The sealing ring 18 has a radially inwardly facing circumferential groove 36 into which the peripheral lip 20 of the skirt extends a substantially equal amount on the upper surface 38 and the lower surface 40 of the skirt 16. Such a balanced arrangement reduces the possibility of the  
10 skirt 16 being stressed and deformed during the moulding process since the skirt 16 is supported by the material of the sealing lip 18 equally on both surfaces 38, 40.

In use, the legs 30 are inserted through an aperture in a metal panel so that the  
15 tapered portions 32 of the legs engage edge portion means of the aperture. Cotermiously, the sealing ring 18 is brought into contact with edge portion means (42 in Figure 5) of the aperture on the other side of the metal panel thus deflecting the skirt 16 which being resilient forces the sealing ring 18 against the edge portion means 42. The skirt 16 is deflectable from the position  
20 shown in Figure 4 at rest to the position shown in Figure 5 in use where it approaches a plane parallel with that of the surface of the metal panel. The sealing ring 18 has a sealing surface 44 which in combination with the force

provided by the skirt 16 seals the aperture from the ingress of moisture. The sealing surface 44 is thin in the radial direction to increase the contact pressure with the metal panel and the fastener 10 is able to seal the aperture up to 300mm head of water.

5

In radial cross-section as shown in Figures 4 and 5 the sealing surface 44 is formed by the intersection of two complimentary surfaces 46, 48 and it will further be seen that the overall radial cross-section shows that the sealing ring 18 is polygonal having seven sides. As best shown in Figure 1 the sealing surface is circular but it may be of any shape suitable for sealing the aperture in question.

10

The sealing surface 44 is located radially inwardly of the outer radial periphery 50 of the lip 20. With this arrangement, the force applied to the sealing ring 18 by the skirt 16 against the metal panel tends to push the peripheral lip 20 more firmly into the groove 36 of the sealing ring 18 and thus prevents disengagement of the sealing ring 18 from the skirt 16.

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The fastener 10 is manufactured by a two shot plastic moulding method in which the sealing ring 18 and the rest of the fastener are moulded sequentially. The rest of the fastener is moulded first and subsequently the sealing ring 18 is moulded to the peripheral lip 20 of the skirt 16.

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The rest of the fastener is moulded from an acetal resin such as Hostaform made by Tricon (ref S9063). The sealing ring 18 is made from a thermoplastic elastomer such as Thermolast K made by Kraiburg. Molecular bonding does not form between acetal resins and thermoplastic elastomers at moulding temperatures sufficiently to prevent disengagement of the sealing ring 18 from the lip 20 of the skirt 16. However, the illustrated arrangement prevents the sealing ring 18 from disengaging from the lip 20 of the skirt 16.

10 The sealing ring 18 is preferably connected to the sprue (not shown) at a radially innermost portion at one circumferential part of the sealing ring to prevent the connection from interfering with the operation of the sealing ring 18 and the skirt 16.

# CLAIMS

1. A fastener for fastening a first element to a second element having edge portion means defining an aperture, the fastener comprising a first engageable means for engaging with said first element and a second engageable means extendable through said aperture for engaging the edge portion means on each side of said second element, said second engageable means including a resilient skirt having a resilient sealing ring moulded to and engaging a peripheral lip thereof, said lip extending into said sealing ring, said sealing ring being engageable with the edge portion means on one side of said second element for sealing the aperture in such a way that disengagement of the sealing ring from the lip is prevented.
2. A fastener as claimed in claim 1, wherein in radial cross-section the sealing ring has a sealing surface formed by the intersection of two complimentary surfaces of the sealing ring.
3. A fastener as claimed in claim 1 or 2, wherein the sealing ring is polygonal in radial cross-section.

4. A fastener as claimed in claim 2 or claim 3 when dependent on claim 2, wherein the sealing surface is radially inward of an outer radial periphery of the lip.
- 5 5. A fastener as claimed in any one of the preceding claims, wherein the lip extends into the sealing lip so that the sealing ring extends substantially equally over an upper and a lower surface of the skirt.
6. A fastener as claimed in any one of the preceding claims, wherein  
10 excluding the sealing ring the fastener is made from acetal resin.
7. A fastener as claimed in any one of the preceding claims, wherein the sealing ring is made from a thermoplastic elastomer.
- 15 8. A fastener substantially as hereinbefore described with reference to the accompanying drawings.



INVESTOR IN PEOPLE

**Application No:** GB 0006238.0  
**Claims searched:** 1-8

**Examiner:** A J Rudge  
**Date of search:** 8 August 2000

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.R): E2A(AAN,ACAF,ACAT)

Int CI (Ed.7): F16B-5/06;21/00;21/06;21/07;21/08;43/00;43/02

Other: Online databases: WPI,EPODOC,JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	US 5,173,026 (ITW de France)- see whole document	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.